DECARBONISING AVIATION:
THE SUSTAINABLE WAY FORWARD

A JUST TRANSITION TO A NET POSITIVE WORLD
A SUSTAINABLE FUTURE FOR THE AVIATION INDUSTRY

The aviation industry requires effective and sustainable solutions to meet its commitments in the global effort to reduce the impact of climate change. While advances in air traffic management, infrastructure efficiency, and other operational measures will help to reduce emissions, aviation fuel will be the most important source of savings if the industry is to achieve its target of carbon neutral growth from 2020 and a 50% reduction on 2005’s emissions levels by 2050.

Industry leaders are seeking to not only demonstrate that they can achieve significant emissions reductions, but that they are able to have a net positive impact on social and environmental sustainability as well. Which is why, when moving to sustainable aviation fuels (SAF), industry leaders look to partner with RSB, which offers unparalleled confidence in climate, social, and environmental impact — through its best-in-class sustainability standard for the entire SAF supply chain.

The only international market mechanism to offset and reduce carbon emissions in aviation is CORSIA: the Carbon Offsetting and Reduction Scheme for International Aviation from the International Civil Aviation Organisation (ICAO). RSB has adapted its best-in-class sustainability standard to incorporate the requirements CORSIA in its new RSB CORSIA Standard — which specifies the requirements for operators along the SAF supply chain to produce SAF that comply with RSB’s sustainability requirements and is eligible under CORSIA — enabling aviation leaders to demonstrate that they are on the forefront of driving a sustainable transformation of this vital industry.

SAF — which can deliver significant reductions in greenhouse gas (GHG) emissions while requiring no changes to existing aircraft and infrastructure — offer the most effective and immediate solution to an industry looking to decarbonise rapidly. However, in order for SAF to be truly sustainable, a reputable sustainability certification is needed in order to demonstrate GHG reductions and an effective approach to achieving sustainable development goals without compromising social development and environmental protection.

RSB supports the development of SAF that promote social and environmental sustainability as well as safeguard food security. We do this by partnering with aviation initiatives worldwide, engaging airlines through membership, and helping supply chain companies achieve RSB certification for their bio-based and advanced fuels.

The drive to develop viable, fully commercialised sustainable aviation fuel (SAF) is gaining momentum. By the beginning of 2020, over 250,000 flights had taken off using SAF blends and over 6 billion litres of offtakes had been achieved. SAF currently accounts for only 0.01% of global jet fuel use but is expected to reach up to 2% by 2025 with the right policy support. Following successful trials, SAF provision is moving towards normalised operation at major international aviation hubs — including Oslo, Brisbane, Toronto and Geneva.

The global SAF market was valued at $168.18 billion in 2016 and is expected to reach $246.52 billion by 2024.

SAF derived from biomass, wastes and other feedstocks can reduce the carbon footprint of aviation fuel by up to 94% over their full lifecycle.

94% GHG reduction over their lifecycle

Source: http://www.atag.org/facts-and-figures.html
**What Is SAF?**

*Sustainable Aviation Fuels (SAF) — sometimes known as aviation biofuels or bio-jet fuels — are low-carbon fuel alternatives for the aviation industry. These non-petroleum-based drop-in aviation fuels are generally produced from bio-based feedstocks including waste, residues and end-of-life products, or fossil waste such as CO₂, waste plastics, and tyres.*

**WHY USE SAF?**

The use of SAF — along with other efficiencies in operations and aircraft design — is intended to reduce the industry’s growing share of greenhouse gas (GHG) emissions and lower the overall climate impact of aviation. However, without proper sustainability certification, some of these fuels risk having negative social and environmental impacts such as negligible GHG emissions reductions (or even increased emissions), reduced food security from repurposing food production land to feedstock production land, environmental degradation from deforestation, and unsustainable soil and water usage.

"RSB’s certification is a crucial step to ensure this revolutionary new fuel will meet the highest possible environmental standards and will result in a radical reduction in our carbon footprint."

— Richard Branson, Virgin Atlantic

"The RSB Standard for Advanced Fuels is instrumental in supporting the development of waste-to-fuels projects. Having clear guidance regarding this certification process gives consumers, producers, investors, and all other stakeholders confidence in the sustainability of these fuels."

— Bruno Miller, Managing Director, Fulcrum Bioenergy
<table>
<thead>
<tr>
<th>ASTM APPROVED PROCESS</th>
<th>DATE OF APPROVAL</th>
<th>FEEDSTOCK OPTIONS</th>
<th>BLENDING RATIO BY VOLUME</th>
</tr>
</thead>
<tbody>
<tr>
<td>FT-SPK</td>
<td>2009</td>
<td>Fischer-Tropsch hydro-processed synthesised paraffinic kerosene</td>
<td>Up to 50%</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Lignocellulosic biomass, Agricultural and forestry residues (e.g. sugarcane bagasse, sugar cane trash, treetops, corn stover and corn stalks) and municipal waste</td>
<td></td>
</tr>
<tr>
<td>HEFA-SPK</td>
<td>2011</td>
<td>Synthesised paraffinic kerosene produced from hydro-processed esters and fatty acids</td>
<td>Up to 50%</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Oils and fats, Camelina, jatropha, castor oil, palm oil, animal fats, and used cooking oil</td>
<td></td>
</tr>
<tr>
<td>HFS-SIP</td>
<td>2014</td>
<td>Synthesised isoparaffins produced from hydro-processed fermented sugars</td>
<td>Up to 10%</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Microbial conversion of sugars to hydrocarbon, Sugarcane, cassava, sorghum, and corn</td>
<td></td>
</tr>
<tr>
<td>FT-SPK/A</td>
<td>2015</td>
<td>Synthesised kerosene with aromatics derived by alkylation of light aromatics from non-petroleum sources</td>
<td>Up to 50%</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Lignocellulosic biomass, Agricultural and forestry residues (e.g. sugarcane bagasse, sugar cane trash, treetops, corn stover and corn stalks) and municipal waste</td>
<td></td>
</tr>
<tr>
<td>ATJ-SPK (isobutanol)</td>
<td>2016</td>
<td>Alcohol-to-jet synthetic paraffinic kerosene</td>
<td>Up to 50%</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Biomass used for sugar production and lignocellulosic biomass, Sugarcane, cassava, sorghum, corn, and ethanol</td>
<td></td>
</tr>
<tr>
<td>ATJ-SPK (ethanol)</td>
<td>2018</td>
<td>Alcohol-to-jet synthetic paraffinic kerosene</td>
<td>Up to 50%</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Biomass used for sugar production and lignocellulosic biomass, Sugarcane, cassava, sorghum, corn, and ethanol</td>
<td></td>
</tr>
<tr>
<td>CHJ</td>
<td>2020</td>
<td>Catalytic hydrothermalysis synthetic jet fuel</td>
<td>Up to 50%</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Triglyceride-based feedstocks, Waste oils, algae, soybean, jatropha, camelina, and carinata</td>
<td></td>
</tr>
<tr>
<td>HHC-SPK</td>
<td>2020</td>
<td>High hydrogen content synthetic paraffinic kerosene</td>
<td>Up to 10%</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Biologically derived hydrocarbons, Algae</td>
<td></td>
</tr>
</tbody>
</table>
A SUSTAINABLE FUTURE FOR THE INDUSTRY

The aviation industry has committed to grow carbon-neutrally as of 2020, and to decrease Greenhouse Gas (GHG) emissions by 50% by 2050.

There's no doubt today that the use of biofuels is essential to achieve the environmental goals of the aviation sector. Nonetheless, we need to ensure that the biofuels suggested are thoroughly compliant with the sustainable development framework. This is the main stake of the collaboration with RSB.

Sylvain Cofsky
Executive Director, Green Aviation Research & Development Network

Goal 1
Improve fleet fuel efficiency by 1.5% per year from now until 2020.

Goal 2
Stabilise net aviation emissions at 2020 levels with carbon neutral growth.

Goal 3
By 2050, net aviation carbon emissions will be half what they were in 2005.
Independent third-party certification schemes are essential to scale the sustainable (aviation) fuel industry. And for us, RSB is the best scheme out there. We’re very proud to be the first certified operator in our market, and it underlines our dedication to stimulate the use of truly sustainable aviation fuel. To further develop this market in a responsible way, sharing knowledge is key and therefore the role of RSB in bringing together all stakeholders is of great importance.

Maarten van Dijk, CEO, SkyNRG

EU RED, ETS AND ReFueLEU AVIATION

European Union policy provides incentives to using SAF via its Renewable Energy Directive (RED) and Emission Trading System (ETS) — which contain mechanisms to reward aircraft operators using SAF. To further boost the supply and demand for SAF in the EU, a new policy initiative called ReFuelEU Aviation will be launched in 2021 which is expected to include a number of policy incentives, such as blending targets, emission multipliers, and financial instruments to increase the price competitiveness of SAF.

SAFUG

The Sustainable Aviation Fuel Users Group (SAFUG) — representing approximately 1/3 of commercial aviation fuel demand — has signed a pledge to source sustainably certified SAF, certified by RSB or an equivalent. This includes consideration of lifecycle GHG emissions and more.

ABOUT RSB’S NEW CORSIA STANDARD

RSB’s ICAO CORSIA Standard specifies requirements for operators along the Sustainable Aviation Fuel (SAF) supply chain to produce SAF that complies with RSB’s sustainability requirements and is eligible under the Carbon Offsetting and Reduction Scheme for International Aviation (CORSIA).

RSB’s best-in-class certification system will work to support the implementation of CORSIA for the aviation industry as a recognised Sustainability Certification System.

The RSB approach — grounded in our most trusted and credible sustainability standard — enables committed airlines to go above and beyond the CORSIA requirements in ensuring that the development of SAF and the planet, and achieves a minimum of 50% GHG reduction on a lifecycle basis.

As of 22 June 2020, 85 nations representing 77% of international aviation activity have voluntarily signed up to The Carbon Offsetting and Reduction Scheme for International Aviation (CORSIA) — which will become compulsory as of 2026.

ABOUT RSB’S NEW CORSIA STANDARD

CORSIA

The Carbon Offsetting and Reduction Scheme for International Aviation (CORSIA) is the only international market mechanism to offset and reduce carbon emissions in aviation and achieve carbon neutral growth from 2021. It is managed by the International Civil Aviation Organisation (ICAO), whose carbon reduction strategy has four components — one of which is scaling up the use of SAF.

CORSIA’s reporting mechanisms require airlines who use SAF to ensure sustainability certification from feedstock producer to final product. RSB has worked on the ICAO’s Alternative Fuels Task Force to develop these requirements and is well-placed to support their implementation.

RSB’s powerful Greenhouse Gas Calculator Tool covers the full scope of the CORSIA methodology from agriculture and transport to processing and is adapted for the CORSIA calculation rules.

Additionally, RSB has a robust GHG auditing and certification system in place, offers regular training for operators and auditors, and can support operators to demonstrate that they are at minimal risk of indirect land use change — via our Low ILUC module.

Supporting airlines to meet their reporting requirements, RSB provides Chain of Custody certification, which ensures that the information necessary to fulfil CORSIA’s reporting requirements is tracked from origin to the user — via continuous documentation of claims and product handling.

SAFUG

The Sustainable Aviation Fuel Users Group (SAFUG) — representing approximately 1/3 of commercial aviation fuel demand — has signed a pledge to source sustainably certified SAF, certified by RSB or an equivalent. This includes consideration of lifecycle GHG emissions and more.

EU RED, ETS AND ReFueLEU AVIATION

European Union policy provides incentives to using SAF via its Renewable Energy Directive (RED) and Emission Trading System (ETS) — which contain mechanisms to reward aircraft operators using SAF. To further boost the supply and demand for SAF in the EU, a new policy initiative called ReFuelEU Aviation will be launched in 2021 which is expected to include a number of policy incentives, such as blending targets, emission multipliers, and financial instruments to increase the price competitiveness of SAF.

“Independent third-party certification schemes are essential to scale the sustainable (aviation) fuel industry. And for us, RSB is the best scheme out there. We’re very proud to be the first certified operator in our market, and it underlines our dedication to stimulate the use of truly sustainable aviation fuel. To further develop this market in a responsible way, sharing knowledge is key and therefore the role of RSB in bringing together all stakeholders is of great importance.”

Maarten van Dijk, CEO, SkyNRG

LEADERSHIP AT SCALE

A growing number of SAF leaders, such as World Energy (formerly AltAir), SkyNRG, Lanzatech, and Gevo, are earning RSB certification and driving the scaling of supply chains and technical capability — as well as the global supply and demand for cleaner fuels. By delivering fuels that are RSB-certified and demonstrate a 60% GHG emissions reduction against the petroleum-based products they replace, producers have a very real impact on the industry’s ability to tackle climate challenges.

About RSB’s new CORSIA standard

As of 22 June 2020, 85 nations representing 77% of international aviation activity have voluntarily signed up to The Carbon Offsetting and Reduction Scheme for International Aviation (CORSIA) — which will become compulsory as of 2026.

From inception World Energy has pledged to its customers a pursuit of the highest standards of sustainability. By achieving RSB certification, we now have third-party verification of field to wing or tank GHG reduction of at least 60%. These measurable results ensure that World Energy customers and their stakeholders are meeting their respective sustainability targets.

Bryan Sherbacow, Chief Commercial Officer, World Energy
Why Work With RSB?

A TRUSTED PARTNER IN THE AVIATION INDUSTRY

RSB supports the development of truly sustainable aviation fuels that safeguard social and environmental sustainability — including the promotion of food security and water stewardship. We do this by developing practical solutions and projects, partnering with SAF initiatives worldwide, engaging airlines through membership, and helping companies and entire supply chains achieve RSB’s most trusted certification for SAF.

Sustainable aviation fuels accounted for 17% of RSB-certified products in 2019.

17% OF RSB-CERTIFIED PRODUCTS

Offers trusted and credible solutions

Is based on a risk-based approach which mitigates business risk

Contributes to the UN Sustainable Development Goals

Enables the protection of ecosystems, high conservation value areas, and biodiversity

Promotes food security and water stewardship

Ensures that Sustainable Aviation Fuels produce at least 50% less GHG emissions than conventional jet kerosene

Mitigates the risk of direct and indirect land use change (ILUC)

Protects and uplifts socioeconomic conditions of farmers and local communities (particularly in developing countries)

ICAO CORSIA Standard adheres to RSB’s most credible and practical approach to sustainability globally, while demonstrating compliance with CORSIA

Sustainability is the most important aspect of SAF deployment and the industry works closely with organisations such as the Roundtable on Sustainable Biomaterials to implement global standards.

- ATAG (Air Transport Action Group)

Source: https://aviationbenefits.org/media/167003/fact-sheet_5_aviation-energy-transition.pdf
Why Work With RSB?

The RSB Principles & Criteria describe how to produce bio-based feedstocks, biomass-derived materials, and alternative fuels in an environmentally, socially and economically responsible way.

**Principle 1: Legality**
Operations follow all applicable laws and regulations.

**Principle 2: Planning, Monitoring & Continuous Improvement**
Sustainable operations are planned, implemented and continuously improved through an open, transparent and consultative impact assessment and management process and an economic viability analysis.

**Principle 3: Greenhouse Gas Emissions**
Alternative fuels contribute to climate change mitigation by significantly reducing lifecycle GHG emissions as compared to fossil fuels.

**Principle 4: Human and Labour Rights**
Operations do not violate human rights or labour rights, and promote decent work and the well-being of workers.

**Principle 5: Rural and Social Development**
In regions of poverty, operations contribute to the social and economic development of local, rural and indigenous people and communities.

**Principle 6: Local Food Security**
Operations ensure the human right to adequate food and improve food security in food insecure regions.

**Principle 7: Conservation**
Operations avoid negative impacts on biodiversity, ecosystems and conservation values.

**Principle 8: Soil**
Operations implement practices that seek to reverse soil degradation and/or maintain soil health.

**Principle 9: Water**
Operations maintain or enhance the quality and quantity of surface and groundwater resources, and respect prior formal or customary water rights.

**Principle 10: Air Quality**
Air pollution shall be minimised along the whole supply chain.

**Principle 11: Use of Technology, Inputs & Management of Waste**
The use of technologies shall seek to maximise production efficiency and social and environmental performance, and minimise the risk of damages to the environment and people.

**Principle 12: Land Rights**
Operations shall respect land rights and land use rights.
Why Work With RSB?

RSB: A JUST TRANSITION TO A NET POSITIVE WORLD

RSB is leveraging its community, resources and best-in-class sustainability standard as part of a global movement to create the following positive impacts:

- The 1.5°C warming cap is achieved
- Fossil is left in the ground
- Maximum circularity is attained
- Global nutrition and water access are assured
- Human and labour rights are guaranteed
- Ecosystems are productive and healthy

WHO IS RSB?

The Roundtable on Sustainable Biomaterials (RSB) is an international, multi-stakeholder, independent organisation that supports the development of the global bioeconomy through sustainability solutions, certification, innovation and collaborative partnerships.

With credible solutions, global expertise, partners across the spectrum from government to industry, academia and NGOs, and an extremely robust approach to sustainability, RSB is the partner of choice for the aviation industry as it seeks to fulfil its global commitments to greenhouse gas reduction while also ensuring social development and environmental protection.

RSB is a member-led organisation which represents a worldwide movement of businesses, NGOs, academics, government, and UN organisations that have demonstrated their commitment to the development of the sustainable bioeconomy by working together to create our most-trusted Standard.

The RSB Standard is the strongest and most trusted of its kind, recognised as such by the World Wildlife Fund (WWF), International Union for Conservation of Nature (IUCN) and Natural Resources Defense Council (NRDC). RSB certification for SAF has been endorsed by aviation groups such as the Aviation Transport Action Group (ATAG) and the International Coalition for Sustainable Aviation (ICSA).
RSB’s Pioneering Approach

PRACTICAL SOLUTIONS FOR A SUSTAINABLE AVIATION INDUSTRY

With credible solutions, global expertise, partners across the spectrum from government to industry and NGOs, and an extremely robust approach to sustainability, RSB’s commitment to significant GHG emission reductions has earned the trust of key aviation organisations, such as the International Coalition for Sustainable Aviation (ICSA) and the Air Transport Action Group (ATAG) — who recommend RSB certification for SAF development.

RSB’s pioneering approach drives continuous improvement, as well as response to new market challenges and opportunities. With truly credible solutions, innovative and advanced approaches to the latest sustainability challenges, and a proven track record in supporting the industry, we are delivering clear benefits and value to partners across the aviation supply chain — from field and factory to fuel tank.

LOW ILUC

RSB’s progressive ILUC module is the first to address the challenges associated with indirect land use change in biomass production and provides SAF the opportunity to carry an additional low ILUC claim along with RSB certification, upon compliance with at least one of these three sets of indicators:
- Waste & Residues
- Unused Land
- Yield Increase

The module is available ahead of new regulations coming into force in the EU and is part of the RSB CORSIA certification scheme.

ADVANCED FUELS

Our Standard for Advanced Fuels covers wastes, residues, and end-of-life products of both biological and non-biological origin, meaning that SAF produced with renewable fossil waste like carbon monoxide or with green hydrogen is able to achieve RSB’s rigorous sustainability certification.

This approach supports the aviation sector in overcoming many of the challenges associated with the so-called first-generation biofuels — such as ILUC, GHG emissions, biodiversity and food security — while also supporting innovation in SAF development.

RSB’S GHG TOOL

RSB’s Greenhouse Gas (GHG) Tool is a market-leading tool based on emission factors and actual activity measurement. The tool integrates both the RSB Global and EU RED (soon-to-be EU RED II) methodologies, as well as CORSIA and enables operators to conduct their individual calculation of actual GHG LCA values to show a better performance than available default values.

By offering the RSB GHG Tool, RSB supports the industry in decreasing their carbon emission impact.

Bioenergy can make an important contribution to providing access to sustainable energy for all. Credible sustainability standards, such as the one developed by the RSB, help manage risks on a project level and promote best practices among producers and processors, complementing sound regional and national energy planning and policy.

Martina Otto, Head of Policy Unit, Energy Branch
UN Environment Programme (UNEP)
RSB is well aligned with the UN Sustainable Development Goals (SDG), and our partners in the aviation industry can be assured that RSB-certified SAF is contributing to the realisation of many of the SDGs. Not only do RSB-certified alternative fuels support SDG requirements on clean energy and climate action, our best-in-class approach to myriad social and environmental issues supports the achievement of many of the other SDGs.
BRINGING MEANINGFUL PARTNERSHIPS AND POLICY TO LIFE WITH RSB

The Roundtable on Sustainable Biomaterials collaborates with government, industry and NGOs worldwide to develop effective partnerships and local, regional and global policy that incorporates our best-in-class approach to sustainability.

NORTH AMERICA
RSB has been growing its engagement in North America via stakeholder engagement and specialised feedstock studies. We carried out research to assess the sustainability and availability of feedstock for SAF production in Alabama and are working closely with Canada’s Green Aviation Research and Development Network (GARDN) to promote sustainability and the RSB standard among regional SAF producers and airlines.

CLEAN SKIES FOR TOMORROW COALITION
Clean Skies for Tomorrow is an initiative of the World Economic Forum which brings together top executives and public leaders across and beyond the aviation value chain to support the financing and scaling of SAF production through co-developed market initiatives. RSB participates as an advisory partner, thus supporting the development of practical solutions to achieve sustainable, low-carbon flying.

EUROPE
RSB is participating in a number of consortia funded by Horizon 2020 (H2020) — the European Union’s Research and Innovation programme — to provide technical advice on feedstock and supply chain sustainability in SAF projects and achieve RSB certification for European SAF supply chains. We also participated in the Fuelling Flight Consensus stakeholder group, led by the European Climate Foundation and the International Council on Clean Transportation, to advocate for a strong sustainability approach to SAF development in Europe.

CHINA
With the support of ClimateWorks Foundation, RSB is undertaking a project in China to initiate the development of a national roadmap for SAF in the country — in consultation with government, industry, and NGO stakeholders.

BRAZIL
Under the project ‘Fuelling the Sustainable Bioeconomy’, powered by Boeing Global Engagement, RSB is supporting the development of SAF in Brazil, with particular focus on engaging smallholder groups, identifying innovative feedstocks such as macaúba and CO, partnering with influential associations and industry players, and promoting sustainable practices across all agricultural sectors.

SOUTH AMERICA
RSB is participating in a resource assessment that will identify the sustainable feedstock potential for SAF production in South America. Led by WWF, the research is modelled around a similar study conducted in Sub-Saharan Africa in 2018 and will integrate the RSB standard as well as population growth and climate change predictions in order to deliver results that allow long-term planning for up to 2050.

ETHIOPIA
A group of experts led by RSB and chaired by the national Ministry of Mines and Petroleum and involving a number of biofuel stakeholders — including the national airlines — has formed a steering committee to work together in developing a national SAF Roadmap which will include feedstock, technology, policy, sustainability, and social development recommendations.

SOUTH AFRICA
RSB is working with the local sugarcane sector to identify opportunities for diversifying into sustainable ethanol production aimed at the alcohol-to-jet SAF market. In collaboration with local government and stakeholders — including WWF South Africa — RSB is also developing an approach for the sustainable certification of invasive alien woody biomass which has potential as a sustainable feedstock option for both the SAF and bioenergy markets, while proactively contributing to ecosystem restoration and job creation.

REGIONAL INDICATORS
RSB has developed regional indicators in the USA, Mexico, South Africa, Ethiopia, Queensland (Australia) and, soon, Brazil — with the goal of easing the process of certification in those regions by taking a risk-based approach to local legislation and regulations, as well as harnessing the results of thorough stakeholder engagement.
ARE YOU READY TO SHAPE THE FUTURE SUSTAINABILITY OF THE AVIATION INDUSTRY?

Support the transformation of the aviation industry into a new global economic opportunity.

"In order to safeguard our future, we must use carbon wisely, and not treat it as a single-use liability. Using wastes and residues as feedstocks is essential to give carbon a second chance at life, making new products that would otherwise come from fossil resources. LanzaTech and our partners turn to RSB to guide us in ensuring that wastes and residues can be used sustainably to create a carbon-smart world."

Jennifer Holmgren, CEO, LanzaTech